

CoO and Co<sub>3</sub>O<sub>4</sub>.

20. (Amended) The molten-salt catalyst according to claim 17, wherein a loading amount of said noble metal falls in a range of from 0.1 to 10 parts by weight with respect to 100 parts by weight of said solid support.

21. (Amended) The molten-salt catalyst according to claim 17, wherein a loading amount of said metal oxide falls in a range of from 1 to 50 parts by weight with respect to 100 parts by weight of said solid support.

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#### BASIS FOR THE AMENDMENT

Claims 1-21 have been amended.

The amendment of Claims 1-21 is supported by the corresponding claims as originally filed.

No new matter is believed to have been entered by the present amendment.

#### REMARKS

Claims 1-21 are pending in the present application.

At the outset, Applicants would like to thank Examiner Hailey for the indication that Claim 6-8 and 11 are allowable (paper number 5, page 7, numbered paragraph 9).

The rejections of Claims 1-5, 9, 12-18, and 20 over U.S. Patent No. 4,943,643 (Pennington '643) and of Claims 1-5, 9, 10, and 12-21 over U.S. Patent No. 4,959,486 (Pennington '486), each under 35 U.S.C. §103(a), are traversed.

The present application provides, in part, a molten-salt catalyst for purifying particulate materials, which are contained in an exhaust gas emitted from an internal combustion engine and contain carbon, and said catalyst comprising:

a solid support; and

a catalytic ingredient *loaded on the solid support* including at least one member selected from the group consisting of silver nitrate, alkali metal nitrate, alkaline-earth metal nitrate and rare-earth nitrate (see Claim 1).

Applicants note that the presently claimed invention is fundamentally different from the molten-salt catalyst disclosed by Pennington '643 and Pennington '486. This distinction is underscored by the differences in the physical interaction between the catalytic ingredient and the solid support.

As stipulated in Claim 1 and further stated in paragraphs [0024] and [0025] (page 9-10), the catalytic ingredient is “loaded on the solid support.” As a result of this loading the object of the present invention, to remove harmful components from exhaust gases of automobiles (i.e., complete oxidation), can be achieved (see paragraph [0001] (page 1)). In contrast, the co-catalyst, which the Examiner cites as reading upon the claimed solid support, is disclosed by Pennington as being “suspended or dispersed” (column 5, lines 19-20 of U.S. Pennington '486 and column 6, lines 41-42 of Pennington '643). The suspension or dispersion of the co-catalyst in the Pennington disclosures even serves a distinct purpose of improving selectivity of chemical industrial materials (i.e., partial oxidation; see entire disclosure of Pennington '643 and Pennington '486). Even on its face, the skilled artisan would recognize the fundamental difference between the physical interaction between the catalytic ingredient and the solid support: “loaded on the solid support” (present claims) versus “suspended or dispersed” (Pennington '643 and Pennington '486); and as such these references can not support a *prima facie* case of obviousness.

Moreover, paragraph [0056] (page 21) relates the importance of this loading to the ultimate effect of the catalyst, stating: “the larger the loading amount of nitrate was, the lower the temperature range of the carbonaceous components combustion.” In the present

invention, the molten-salt catalyst is loaded in a range of from 1 to less than 120 parts by weight with respect to 100 parts by weight of solid support (see [0022] of the specification and Claim 16). Even if the molten-salt catalyst enters a liquid phase, the condition in which the molten-salt catalyst is fixed on the solid support is maintained. Applicants note that this is because the molten-salt catalyst is not fluidized in a macroscopic sense, but rather is fluidized in a microscopic sense.

On the opposite side of the spectrum, the fluidized molten-salt (such as  $\text{LiNO}_3$ ) in Pennington '643 and Pennington '486 is used in a range of from 20 to 40 mol% as an endothermic material for an exothermic reaction in a reaction vessel, such as an autoclave (Pennington '486 column 6, line 61). The molten-salt catalyst used in this process is not fixed on the solid solution and is fluidized in a macroscopic view. Thus, the co-catalyst disclosed by Pennington '643 and Pennington '486 is "suspended or dispersed."

As a result of the differences in construction of the molten-salt catalyst highlighted above, differences are also seen in the effect produced thereby. In the present invention, the solid component, such as carbon, is captured and oxidized by a molten-salt component which is fixed on the support. In contrast, in Pennington '643 and Pennington '486 the temperature is maintained by using the molten-salt as an endothermic material, and thereby the retention of the reaction conditions gives rise to improved selectivity.

Further, the presently claimed catalyst offers an additional advantage in that it may be used in the same manner as a convention catalyst (i.e., an under floor catalyst). In contrast, if the catalyst disclosed by Pennington '643 and Pennington '486 were used as an under floor catalyst, significant complications such as loss of pressure will occur and thus the Pennington catalysts would be unsuitable for this purpose.

Based on the foregoing, the obviousness rejections over Pennington '643 and Pennington '486 are not tenable. Accordingly, Applicants respectfully request withdrawal of

these grounds of rejection.

The rejection of Claims 1-21 under 35 U.S.C. §112, second paragraph, is obviated by amendment. Applicants have amended the claims to remove the objected to term.

Withdrawal of this ground of rejection is requested.

Applicants submit that the application is now in condition for allowance, and early notification of such action is earnestly solicited.

Respectfully submitted,

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IN THE CLAIMS

Please amend the claims as follows:

1. (Amended) A molten-salt [type] catalyst for purifying particulate materials, which are contained in an exhaust gas emitted from an internal combustion engine and contain carbon, and said catalyst comprising:

a solid support; and

a catalytic ingredient loaded on the solid support including at least one member selected from the group consisting of silver nitrate, alkali metal nitrate, alkaline-earth metal nitrate and rare-earth nitrate.

2. (Amended) The molten-salt [type] catalyst according to claim 1, wherein said solid support is a basic support.

3. (Amended) The molten-salt [type] catalyst according to claim 1, wherein said catalytic ingredient includes alkali metal nitrate.

4. (Amended) The molten-salt [type] catalyst according to claim 1, wherein said catalytic ingredient further includes an oxidation facilitating ingredient.

5. (Amended) The molten-salt [type] catalyst according to claim 1, wherein said solid support includes at least one member selected from the group consisting of alumina, zirconia, titania, silica and zeolite.

6. (Amended) The molten-salt [type] catalyst according to claim 2, wherein said basic support includes at least one member selected from the group consisting of magnesia spinel,

zirconia, alkali metal oxide, alkaline-earth metal oxide and rare-earth oxide.

7. (Amended) The molten-salt [type] catalyst according to claim 6, wherein said alkaline-earth metal oxide is magnesia.

8. (Amended) The molten-salt [type] catalyst according to claim 6, wherein said rare-earth metal oxide is at least one member selected from the group consisting of lanthanum oxide and neodymium oxide.

9. (Amended) The molten-salt [type] catalyst according to claim 1, wherein said alkali metal nitrate is at least one member selected from the group consisting of  $\text{KNO}_3$ ,  $\text{CsNO}_3$ ,  $\text{NaNO}_3$  and  $\text{LiNO}_3$ .

10. (Amended) The molten-salt [type] catalyst according to claim 1, wherein said alkaline-earth metal nitrate is at least one member selected from the group consisting of  $\text{Ba}(\text{NO}_3)_2$ ,  $\text{Sr}(\text{NO}_3)_2$ ,  $\text{Ca}(\text{NO}_3)_2$  and  $\text{Mg}(\text{NO}_3)_2$ .

11. (Amended) The molten-salt [type] catalyst according to claim 1, wherein said rare-earth nitrate is at least one member selected from the group consisting of  $\text{Y}_2(\text{NO}_3)_3$ ,  $\text{La}_2(\text{NO}_3)_3$ ,  $\text{Nd}_2(\text{NO}_3)_3$  and  $\text{Pr}_2(\text{NO}_3)_3$ .

12. (Amended) The molten-salt [type] catalyst according to claim 1, wherein said catalytic ingredient is composite nitrate.

13. (Amended) The molten-salt [type] catalyst according to claim 12, wherein said composite nitrate is at least one member selected from the group consisting of  $\text{AgNO}_3$ ,  $\text{CsNO}_3$ ,  $\text{CsNO}_3\text{-KNO}_3$ ,  $\text{CsNO}_3\text{-NaNO}_3$ ,  $\text{CsNO}_3\text{-LiNO}_3$ ,  $\text{KNO}_3\text{-Mg}(\text{NO}_3)_2$ ,  $\text{LiNO}_3\text{-NaNO}_3$ ,  $\text{NaNO}_3\text{-Ca}(\text{NO}_3)_2$ ,  $\text{NaNO}_3\text{-Mg}(\text{NO}_3)_2$ ,  $\text{AgNO}_3\text{-KNO}_3\text{-NaNO}_3$ ,  $\text{AgNO}_3\text{-NaNO}_3\text{-Ba}(\text{NO}_3)_2$ ,  $\text{KNO}_3\text{-LiNO}_3\text{-NaNO}_3$ ,  $\text{KNO}_3\text{-NaNO}_3\text{-Mg}(\text{NO}_3)_2$ ,  $\text{KNO}_3\text{-Ba}(\text{NO}_3)_2\text{-Ca}(\text{NO}_3)_2$ ,  $\text{KNO}_3\text{-Ba}(\text{NO}_3)_2\text{-Sr}(\text{NO}_3)_2$ ,  $\text{KNO}_3\text{-Ca}(\text{NO}_3)_2\text{-Sr}(\text{NO}_3)_2$ ,  $\text{LiNO}_3\text{-NaNO}_3\text{-Ca}(\text{NO}_3)_2$ ,  $\text{NaNO}_3\text{-Ca}(\text{NO}_3)_2\text{-Mg}(\text{NO}_3)_2$ ,  $\text{NaNO}_3\text{-Ca}(\text{NO}_3)_2\text{-Sr}(\text{NO}_3)_2$  and  $\text{KNO}_3\text{-NaNO}_3\text{-Ca}(\text{NO}_3)_2\text{-Mg}(\text{NO}_3)_2$ .

14. (Amended) The molten-salt [type] catalyst according to claim 1, wherein said

catalytic ingredient includes alkali metal nitrate.

15. (Amended) The molten-salt [type] catalyst according to claim 14, wherein said alkali metal includes  $\text{LiNO}_3$  at least.

16. (Amended) The molten-salt [type] catalyst according to claim 1, wherein a loading amount of said catalytic ingredient falls in a range of from 1 to less than 120 parts by weight with respect to 100 parts by weight of said solid support.

17. (Amended) The molten-salt [type] catalyst according to claim 4, wherein said oxidation facilitating ingredient is at least one member selected from the group consisting of noble metal and oxide.

18. (Amended) The molten-salt [type] catalyst according to claim 17, wherein said noble metal is at least one member selected from the group consisting of Pt, Pd and Rh.

19. (Amended) The molten-salt [type] catalyst according to claim 17, wherein said oxide is at least one member selected from the group consisting of  $\text{CeO}_2$ ,  $\text{ZrO}_2$ ,  $\text{CeO}_2\text{-ZrO}_2$  solid solutions, BaO, CaO,  $\text{V}_2\text{O}_5$ , ZnO,  $\text{WO}_3$ ,  $\text{MoO}_3$ , NiO, FeO,  $\text{Fe}_3\text{O}_4$ ,  $\text{Fe}_2\text{O}_3$ ,  $\text{MnO}_2$ ,  $\text{Cr}_2\text{O}_3$ , CuO, CoO and  $\text{Co}_3\text{O}_4$ .

20. (Amended) The molten-salt [type] catalyst according to claim 17, wherein a loading amount of said noble metal falls in a range of from 0.1 to 10 parts by weight with respect to 100 parts by weight of said solid support.

21. (Amended) The molten-salt [type] catalyst according to claim 17, wherein a loading amount of said metal oxide falls in a range of from 1 to 50 parts by weight with respect to 100 parts by weight of said solid support.